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Original Research Article

To Study the Effect of Type 2 Diabetes Mellitus on Lipid Profile Levels

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Abstract

Background: Diabetes mellitus (DM) is one of the most common metabolic disorders. Type-2 diabetic patients have increased risk of cardiovascular disease including atherosclerosis and dyslipidaemia.

Materials and Methods: A total of N=50 control who were between 35-50 years both sexes matched, healthy non-smokers, non-alcoholics were included and N=50 diabetic patients who were on anti-diabetic treatment were enrolled. Aim is to assess the lipid profile of diabetic patients and to compare them with that of the controls.

Results: Triglyceride (TG), very low-density lipoprotein (VLDL), total cholesterol (TC) and low-density lipoprotein (LDL) values were significantly increase whereas high density lipoprotein (HDL) values were decrease in diabetics than controls.

Conclusion: Diabetes mellitus has an impact on lipid metabolism. Dyslipidaemia was reported in the diabetic group. Diabetic patients are prone to cardiovascular and coronary artery diseases. Hence, regular lipid profile monitoring will help to prevent above diseases.

Keywords: Diabetes Mellitus, Lipid Profile.

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Introduction

Diabetes mellitus (DM) is a metabolic disorder characterised by increase in blood glucose level either due to defect in insulin secretion or due to insulin resistance.[1] The Diabetes Atlas 2012 published by the International Diabetes Federation about 61.3 million people had diabetes. By 2030 about 101.2 million will be diabetic.[2] Dyslipidemia is common in diabetic patients. The diabetic ketoacidosis was one of the major fatal complication of diabetes, till the advent of insulin. Insulin resistance and obesity both results into dyslipidemia.[3]

The chronic hyperglycemia leads to dysfunction of nerves, eyes, kidneys and cardiovascular diseases.[4] Myocardial infarction is one of the leading causes of morbidity and mortality.[5] Diabetic dyslipidemia have increased level of total cholesterol, high triglycerides, low high density lipoprotein cholesterol and increased LDL levels. Dyslipidaemia are common in T2DM and prediabetes patients.[6] but the different lipids pattern vary as per ethnicity, socio economic status and accessibility to health care.[7,8] T2DM have an increased risk for CAD with high triglyceride and low HDL-C combined as compared to two lipid parameters studied separately.[9,10] The lipid profile measurement of diabetic patients is required to study how the lipid metabolism is affected by diabetes, as they have different lifestyles and genetic.

Aim: Aim is to assess the lipid profile values in diabetic group and to compare them with that of the control group.

Material and Methods

Informed consent was taken. A case control study was conducted. The research took place between Jan 2026 and May 2026 within the Dept of Physiology, NSMCH, and Patna

Inclusion Criteria: N=50, Type 2 DM patients aged between 30-50 years were enrolled. Diabetes duration was more than 3 years. Diabetic patients who were not suffering from hypertension,

ischaemic heart disease, and oxidative stress were selected. Diabetes diagnosis was based on revised criteria according to the National Diabetes Data Group and WHO. N=50, healthy subjects who were not on any antioxidant medicines were selected. 4ml venous blood was withdrawn in the fasting condition, about 1ml was withdrawn in oxalate-fluoride containing tube for Fasting Plasma Glucose (FPS). For Post Prandial Plasma Glucose (PPBS), after 2 hours of food intake, about 1ml venous blood was withdrawn into oxalate-fluoride containing tube for PPPS estimation.

With the help of AI - therapy statistics BETA sample size was calculated. Effect size was 0.8 and an alpha of 0.05.[11] Power was 80% for one tailed hypothesis. [12] A total of 100 subjects were required, 50 per group.

Exclusion Criteria: Chronic illness, smokers and alcoholics, hypertensives, heart diseases hypothyroidism, on lipostatic drugs, familial hyperlipidemia were excluded.

Biochemical parameters like fasting blood sugar (FBS) and post prandial blood sugar (PPBS), was done by Glucose Oxidase Peroxidase (GOD POD) Method (Enzymatic method). Fasting serum triglycerides (TGs) Glycerol Phosphate Dehydrogenase and Peroxidase method (GPO-POD), [Spinreact kit]. Total cholesterol (TC) Liquid Cholesterol oxidase and peroxidase method (CHOD-POD) [Spinreact kit], high-density lipoprotein cholesterol (HDL-C) HDL Precipitant Diatek kit, Low Density Lipoprotein C= Total cholesterol - (VLDL + HDL Cholesterol) by Friedwald equation. Very Low-Density Lipoprotein: VLDL levels are calculated. It is obtained by dividing the Triglyceride level by 5 (TGL / 5). All the parameters were given in mg/dl. The statistical significance was evaluated by the student's t-test. Body mass index as weight kg/height m2 was calculated.[13]

Statistical Analysis: GRAPHPAD QUICKCALCS online student unpaired t-test was used for data analysis for lipid profile between diabetic and control group. The statistical significance was at p value < 0.05.

Result

Table 2 shows that TC-Total cholesterol, TGs-Triglycerides, LDL- Low density lipoprotein, VLDL-Very low density lipoprotein, the lipid profile are increase significantly in diabetic and High density lipoprotein HDL-C was significantly lower in diabetic patients than control groups.

Table 1: Demographic Data

Parameters	Group 1 (n=50)	Group 2 (n=50)
Age (Years)	41.21 (3.2)	35.57(1.7)
Weight(Kg)	69.13 (5.60)	55.17 (4.85)
Height (cm)	164.71(5.22)	165.86 (4.88)
BMI	25.5(2.62)	20.1 (1.12)
FBS (mg/dl)	161.61 ± 61.41	90.21 ± 3.24
PPBS(mg/dl)	239.41 ± 81.17	110.31 ± 2.31

p < 0.05 – Statistically Significant. p < 0.001 – Statistically Highly Significant. FBS - Fasting Blood Sugar, PPBS - Post Prandial Blood Sugar

Table 2- Lipid profile parameters in Group 1 Diabetic and Group 2 control

Lipid Profile (mg/dl)	Group 1 Diabetic Mean ± SD (n=50)	Group 2 Control Mean ± SD (n=50)	P Value
TC (mg/dl)	183.02 ± 22.61	169.2 ± 31.20	<0.012*
TGs (mg/dl)	156.34 ± 32.11	107.2 ± 27.2	<0.0001**
HDL-C (mg/dl)	37.38 ± 5.4	42.2 ± 5.3	<0.0001**
LDL-C (mg/dl)	137.06 ± 43.5	107.3 ± 32.2	<0.0002**
VLDL-C (mg/dl)	31.87 ± 11.3	23.23 ± 3.21	<0.0001**

***p < 0.05 – Statistically Significant. **p < 0.001 – Statistically Highly Significant. TC -Total cholesterol, TGs - Triglycerides, HDL - High density lipoprotein, LDL - Low density lipoprotein, VLDL -Very low density lipoprotein**

Discussion

This study has shown that the lipid parameters were increase significantly in diabetic patients except HDL-C which was decrease in diabetic groups. Increase triglyceride levels lead to increase in free fatty acid levels, which leads to dysfunction of insulin receptors and β-cells. Hence, hyperglycemia regulation with elevated triglycerides is difficult as compared to those with normal triglyceride levels. The increase lipids play an important role in diabetes, not only by hyperlipidemia but through atherosclerosis also.[14,15] Renuka Suvarna et al. reported increase in total cholesterol. Total cholesterol of cases was (183.02 ± 22.61 mg) and controls was (169.2±31.20 mg). In above study, the

triglyceride values of the diabetic patients was increased (156.34 ± 32.11 mg/dl) compared to controls (107.2 ± 27.2 mg/dl).

The study by Renuka et al. supported above findings. Excessive lipolysis in adipose tissues of diabetics leads to increased free fatty acids level in circulation. Esterification of the free fatty acids in liver leads to triglyceride formation. Increased triglyceride levels in both types of diabetes is increased as reported by other studies.[16] A decrease in HDL level amongst diabetic cases (37.38 ± 5.4 mg/dl) as compared to controls (42.2 ± 5.3 mg/dl). Renuka Suvarna et al., reported decrease in HDL levels in case of diabetics.[17] Inoue et al. reported altered HDL in diabetes. In type 2 diabetes, hypertriglyceridemia is caused by insulin resistance by increase in free fatty acids. Mean levels of LDL in diabetic patients was 137.06 ± 43.5 mg/dl as compared to control as 107.3 ± 32.2 mg/dl. The VLDL levels with diabetes was (31.87+ 11.3) as compared to controls (23.23 + 3.21). The increase TGL & VLDL in patients lead to increase LDL, a metabolite of VLDL. Hyperglycaemia leads to protein glycosylation, i.e collagen cross linking in arterial wall. This causes endothelial cell dysfunction which leads to atherosclerosis. Routine investigation and proper treatment of hyperlipidemia in diabetic patients will definitely prevent cardiovascular and cerebrovascular diseases. Proper diet and regular exercise will prevent diabetic dyslipidemia, if not then medical treatment will be helpful.[18]

Conclusion

The diabetic patients had increased levels of serum cholesterol, triacylglycerol and LDL-C indicating an impact on lipid metabolism. Diabetic patients are prone to cardiovascular and coronary artery diseases. Hence regular lipid profile monitoring will help to prevent above diseases. Regular diabetes screening, weight management, diet control, regular exercise is necessary for obese type 2 diabetic patients, which will prevent complications due to Diabetes Mellitus.

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